

***Stipa baktashevae*, a new synonym of *Stipa borysthenea* (Poaceae)**

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Numerical analyses of macromorphological characters of specimens of *S. lessingiana*, *S. borysthenea* and *S. baktashevae*, nested the last one among individuals of *S. borysthenea*. We propose synonymization of *S. baktashevae*, the species described in 2014 and known only from type material, with *S. borysthenea*, and provide morphological comparisons of the taxa.

Keywords: multivariate analysis, *Stipa lessingiana*, synonymization

Stipa Linnaeus (1753: 78) s.l. is one of the largest genera of Poaceae. Circumscribed broadly it comprises over 300 species common in steppe zones of Central Asia, Southern Europe, Australia and the Americas. However, according to the results of recent studies based on morphological and genetic data, all Australian, American and a subset of Eurasian species of *Stipa* s.l. have been removed from the genus, limiting *Stipa* s.s. to about 150 species, distributed in warm temperate regions of the Old World (Roshevitz 1934, Barkworth 2007, Bor 1970, Tzvelev 1968, 1976, Martinovský 1980, Freitag 1985, Wu & Phillips 2006, Hamasha *et al.* 2012, Romaschenko *et al.* 2012, Nobis 2013, Nobis *et al.* 2016a, 2016b, Nobis & Gudkova 2016).

Stipa baktashevae Tzvelev (2014: 7) was recently described from material collected on sandy grasslands in the Republic of Kalmykia (southwest Russia). The author pointed out that the species originated from hybridization of *S. borysthenea* Klovov ex Prokudin (1951: 25) and *S. lessingiana* Trinius & Ruprecht (1842: 79). Based on the original description *S. baktashevae* has morphological characteristics intermediate between the two putative parental species, including: leaves of vegetative shoots 0.4–0.5 mm in diameter, abaxial surface scabrous due to pointed tubercles, adaxial surface scabrous; ligules very short, 0.4–0.5 mm long; lemmas 15–18 mm long, distance from the end of ventral line of hairs to the top of antherium 4–5 mm; awns 25–32 cm long, bigeniculate with lower part (column) glabrous and upper part (seta) plumose, with hairs 3–4.5 mm long (Tzvelev 2014).

During revision of herbarium materials of *Stipa* we came across type material of *Stipa baktashevae* and found morphological variation in the taxon to differ somewhat from that described in the protologue. Based on measurements made by us on the holotype—the only known specimen of the taxon—ligules of vegetative leaves are 0.4–1.5 mm long (not 0.4–0.5 mm, as stated in the diagnosis); hairs on the lower part of seta are generally 4.0–4.5 mm long (not 3.0–4.5 mm long) and the antherium is 16.5–18.5 mm long (instead of 15–18 mm long). In *S. borysthenea* ligules of vegetative leaves are (0.4–)0.9–2.2(–3.4) mm long, hairs on seta are 4.5–6.9 mm long (however, their length can be variable, and occasional hairs somewhat shorter than 4.5 mm long were found) and the antherium is 16–20 mm long. In *S. lessingiana* leaves are scabrous to hairy-scabrous (due to prickles, spinules and hairs, which occur on the abaxial leaf-surface), ligules of vegetative leaves are 0.05–0.25 mm long, hairs on seta are generally 1.8–3.5 mm long and the antherium is ca. 8.0–12.5 mm long. In *S. baktashevae* leaves of vegetative shoots are scabrous to glabrous; older leaves are scabrous sometimes glabrous and younger leaves are glabrous or almost glabrous.

The same situation can be observed in *S. borysthenea* and *S. pennata*, in which leaves of vegetative shoots range from glabrous to scabrous (even in one individual). Considering characters of the lemma, *S. baktashevae* does not differ from typical specimens of *S. borysthenea*; hairs are arranged in seven lines, of which dorsal and subdorsal lines of hairs are slightly fused at the base, the dorsal line with hairs ca. 0.3–0.5 mm long, terminating at 1/3–1/2 of the lemma length about 7.5–9 mm below the apex of the lemma; and the ventral line with hairs 0.3–0.7 mm long, terminating at 1/2–2/3 of the lemma length, about 5.0–6.0 mm below the apex and the top of lemma is glabrous. In *S. lessingiana* the

lemma is continuously covered by dense hairs, 0.3–1.2 mm long, or glabrous at 0.5–2.5 mm below the apex, the top of lemma with a ring of hairs 1–1.5 mm long. *Stipa baktashevae* and *S. borysthenica* have quite long calluses (3–4 and 3.4–4.8 mm long, respectively) as well as long glumes ca. 50–60 mm and 41–75 mm long, respectively, whereas in *S. lessingiana* the callus is 1.5–2.5 mm long and the glumes are 20–34 mm long.

To characterize variation within and among these three taxa, multivariate morphometric analysis was performed on characters (Table 1) scored on 131 specimens from AA, BRNU, B, FRU, GOET, JE, FR, K, KRA, KRAM, LE, M, MHA, MSB, MW, OP, OSTR, P, PE, POZ, PR, SZCZ, TK, TRN, UPS, W, WA, SZUB, and representing the three species (75 – *S. borysthenica*, 55 – *S. lessingiana* and 1 – *S. baktashevae*). Principal component analysis (PCA) was conducted on 13 quantitative characters, whereas principal coordinate analysis (PCoA) was performed based on 13 quantitative and 2 qualitative characters. Analyses were carried out using STATISTICA v. 10 (Statsoft Inc. 2011) and PAST v. 3.12 (Hammer *et al.* 2001). For methods see Nobis *et al.* (2016a). Principal component analysis (PCA) resulted in delimitation of two main clusters corresponding to *S. borysthenica* and *S. lessingiana*. The operational taxonomic unit (OTU) corresponding to *S. baktashevae* is placed within the cluster of OTUs representing *S. borysthenica* (Fig. 1A). *Stipa borysthenica* and *S. lessingiana* are clearly separated along the first axis, which explains over 65% of the variance in the data set. Eleven characters: AL, CL, LHS, LG, LigV, AwnL, WV, SW, Col₂L, Col₁L and LHV_L had high factor loadings (<0.60) on the first axis (Fig. 1B), thereby they are most useful for distinguishing the two taxa. Only one character (LHA) displayed high correlation with the second axis (Fig. 1B), which explains only 8.12% of total variance. The PCoA, performed on all quantitative and qualitative characters, displays a pattern similar to that described above, grouping OTUs representing *S. lessingiana* on the left side and the single specimen of *S. baktashevae* within a cloud of OTUs of *S. borysthenica* on the right (Fig. 2). This demonstrates that, even after taking into account the qualitative characteristics (which are often treated as diagnostic features), the individual of *S. baktashevae* does not differ from those representing *S. borysthenica*.

From the morphological data, there is no evidence that *Stipa baktashevae* represents a distinct taxon, or originated via hybridization. Taking into account the overlapping variation in *S. baktashevae* and *S. borysthenica*, we regard the former taxon as conspecific with *S. borysthenica*.

TABLE 1. Morphological characters used in the analyses.

| Abbreviation | Character |
|-----------------------|---|
| Quantitative features | |
| AL | length of anthecium (mm) |
| AwnL | length of awn (mm) |
| CL | length of callus (mm) |
| Col ₁ L | length of lower segment of awn (mm) |
| Col ₂ L | length of middle segment of awn (mm) |
| LigV | length of ligules of vegetative leaves (mm) |
| LG | length of glumes (mm) |
| LHA | length of hairs on anthecium (mm) |
| LHS | length of hairs on seta (mm) |
| LHV _L | length of hair on adaxial surface of vegetative leaves (mm) |
| SW | width of seta (mm) |
| WA | width of anthecium (mm) |
| WV | width of vegetative leaves (mm) |
| Qualitative features | |
| HVL | character of abaxial surface of vegetative leaves (1 – glabrous to slightly scabrous; 2 – hairy scabrous) |
| LH | hairs on lemma (1—arranged in lines; 2—not in lines) |

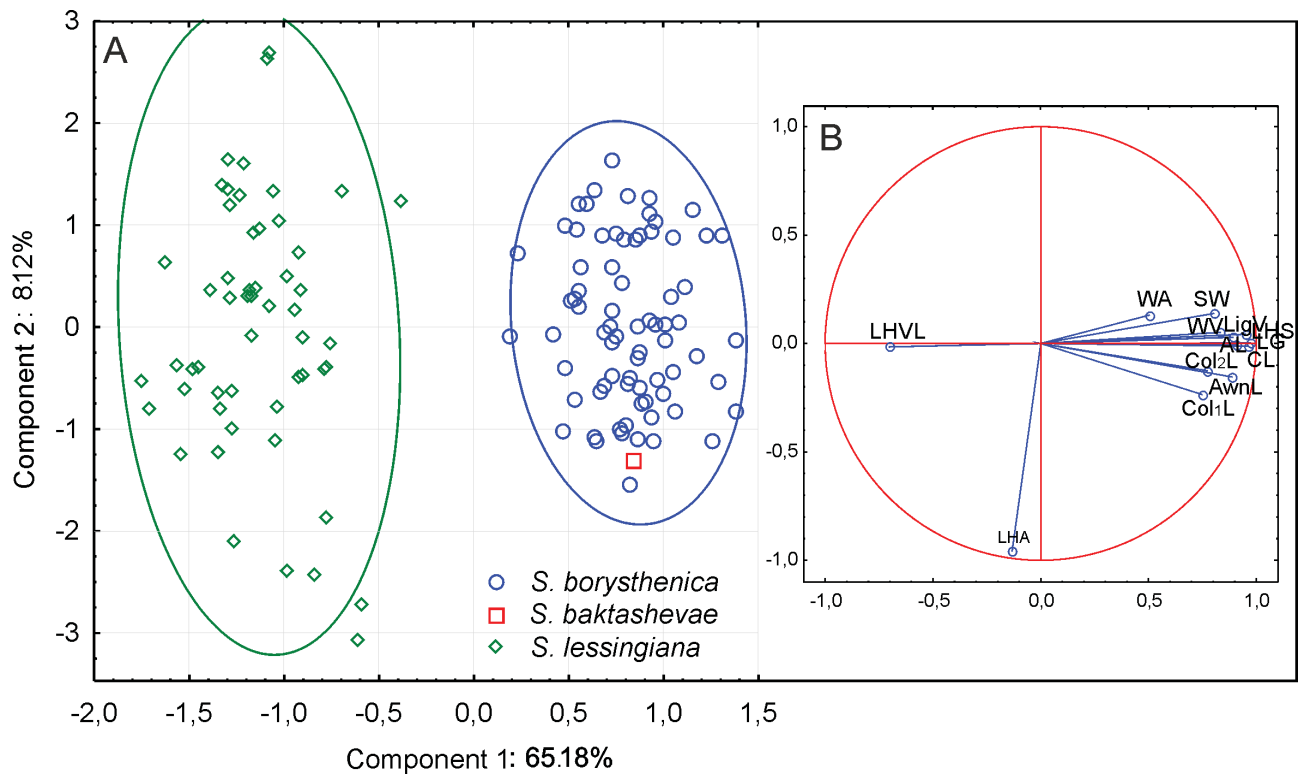


FIGURE 1. A. Biplot of principal component analysis (PCA) performed on 13 quantitative characters. Ellipses indicate 95% confidence interval. B. Character loadings along first and second axes. Character abbreviations are given in Table 1.

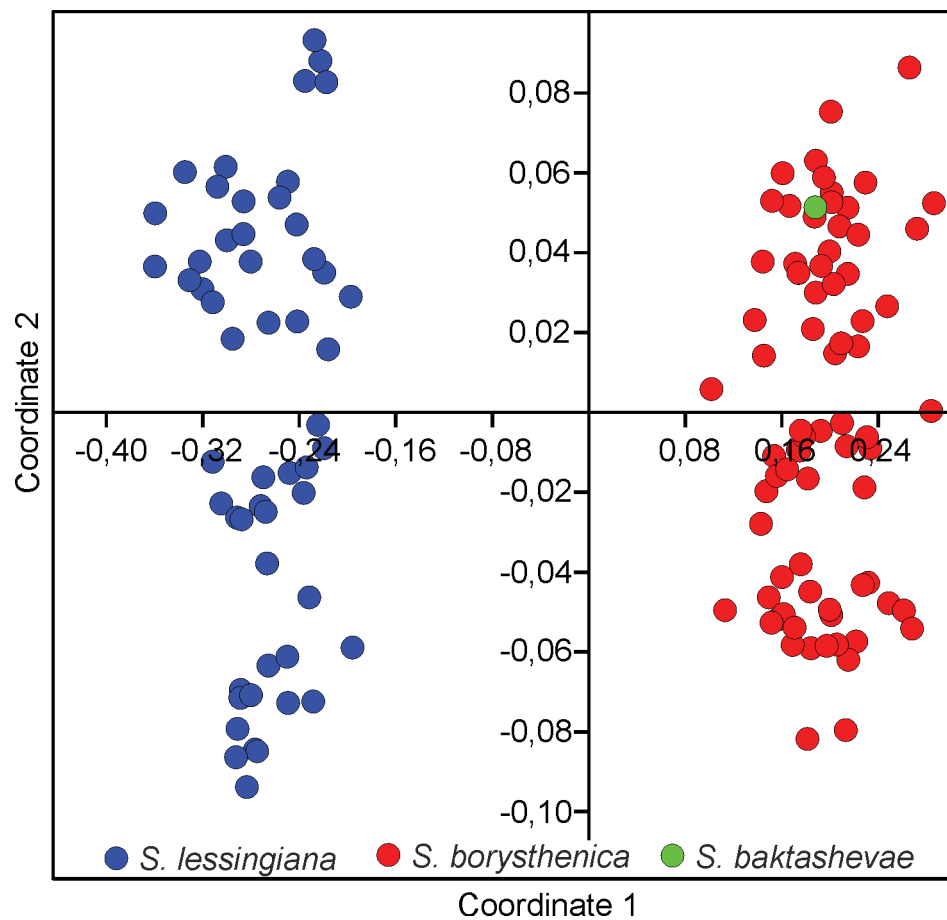


FIGURE 2. Plot of principal coordinate analysis case scores (Gower General Similarity Coefficient) performed on 15 characters.

Formal treatment

Stipa borysthena Klovov ex Prokudin (1951: 25)

Type:—[Ukraine] Lugov forest country house, Tyasmin, Aleks, u., 18 May 1911, *I. Paczowski* (lectotype LE!, selected by Tzvelev 1976: 591).

= *Stipa baktashevae* Tzvelev (2014: 7), *syn. nov.*

TYPE:—Republic of Kalmykiya, Tselinnyi district, outskirts of the Solnechnyi settl., sandy slope among psammophytes, 21 May 2011, *E. Egorova, N. Baktasheva* (holotype LE 01009340!).

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